Biomedical polymers have a great potential in medicine due to their biocompatible nature and versatility. However, their low surface energy leads to a cell adhesion and proliferation that is far less than optimal. To make them excellent candidates for implants and tissue engineering scaffolds, a surface modification is required. By using a medium pressure dielectric barrier discharge operating in different gases, the surface of several flat and/or porous biomedical polymers (PLA, PCL, PHB/PHV) is modified. The plasma treated samples are analyzed by water contact angle measurements and X-ray photoelectron spectroscopy to determine the influence of the plasma treatment. It is found that the plasma treatment is capable of increasing the wettability of the samples as shown by the strong decrease in water contact angle. The increased hydrophilic character is due to the incorporation of different oxygen-containing functionalities at the surface. In some cases, also a small amount of nitrogen can be detected. Cell culture tests are performed to determine if the cell adhesion and proliferation can be enhanced by the treatment. After sterilization, human foreskin fibroblasts are seeded on the surface of the untreated and plasma treated samples. After 1 and 7 days of incubation, phase contrast light microscopy, fluorescence microscopy, colorimetric MTT assay and PrestoBlue assay are used to examine the cell viability, adhesion, spreading and proliferation.